

## On Distribution and Morphology of Cultivated Rice in Senegal

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(Received for Publication October 19, 1987)

### Introduction

During the period from October to November in 1985, the writers took a trip in Senegal for collecting the wild and cultivated rices under the project, "Studies on the Distribution and Ecotypic Differentiation of Wild and Cultivated Rice Species in Africa", supported by a Grant from the Ministry of Education, Science and Culture of the Japanese Government. In this opportunity, cultivated rices distributed in Senegal were studied.

On the distribution of cultivated rice in Senegal, some reports have already been published<sup>1,2,4</sup>. In this trip, various types of cultivated rice, distributed and under the cultivation, were collected in Senegal. In this report, only the habitat and record of morphological characters of unhusked grains of the cultivated rice collected in Senegal were described. Based on the analyses of the data obtained in the further morphological characters, varietal variations are going to be informed in the following papers.

The writers are most grateful to the government officials in Senegal. Thanks are also due to the following persons; Mon. Keba Birane CISSE, Mon. Dr. Balla Moussa DAFPE, Mon. Moctar TOURE, Mon. Papa Ibrahima THIONGANE, Mon. B. SADIO, Mon. FAYE, Mon. M. FALL, Mon. W. GODDERIS, Mon. H. van BRANDT, Mon. Alfred SAMBOU.

### Abstract of distribution and habitat of cultivated rice

Geographical distributions and habitats of cultivated rice collected in Senegal were briefly illustrated in Figs. 1 and 2, in which the routes of trip and the collection-sites of seed samples are given, too.

#### I. *Oryza sativa* L.

Seed samples of the species were collected from the following districts; Guidel, Niaguis, Adeane, Diagon, Kaour, Djibanar, Banbatou, Biaro, Kafoutine and Richard Toll. GAMBIA; Banjul. Those were found in rainfed paddy fields, shallow water paddy fields and upland fields.

#### II. *Oryza glaberrima* STEUD.

Seed samples of the species were collected from the following districts; Ziguinchor, Boutoupo, Agnack, Adeane, Diagon, Goudomp, Simbandi, Amdoulaye, Dar es Salaam, Kitim,

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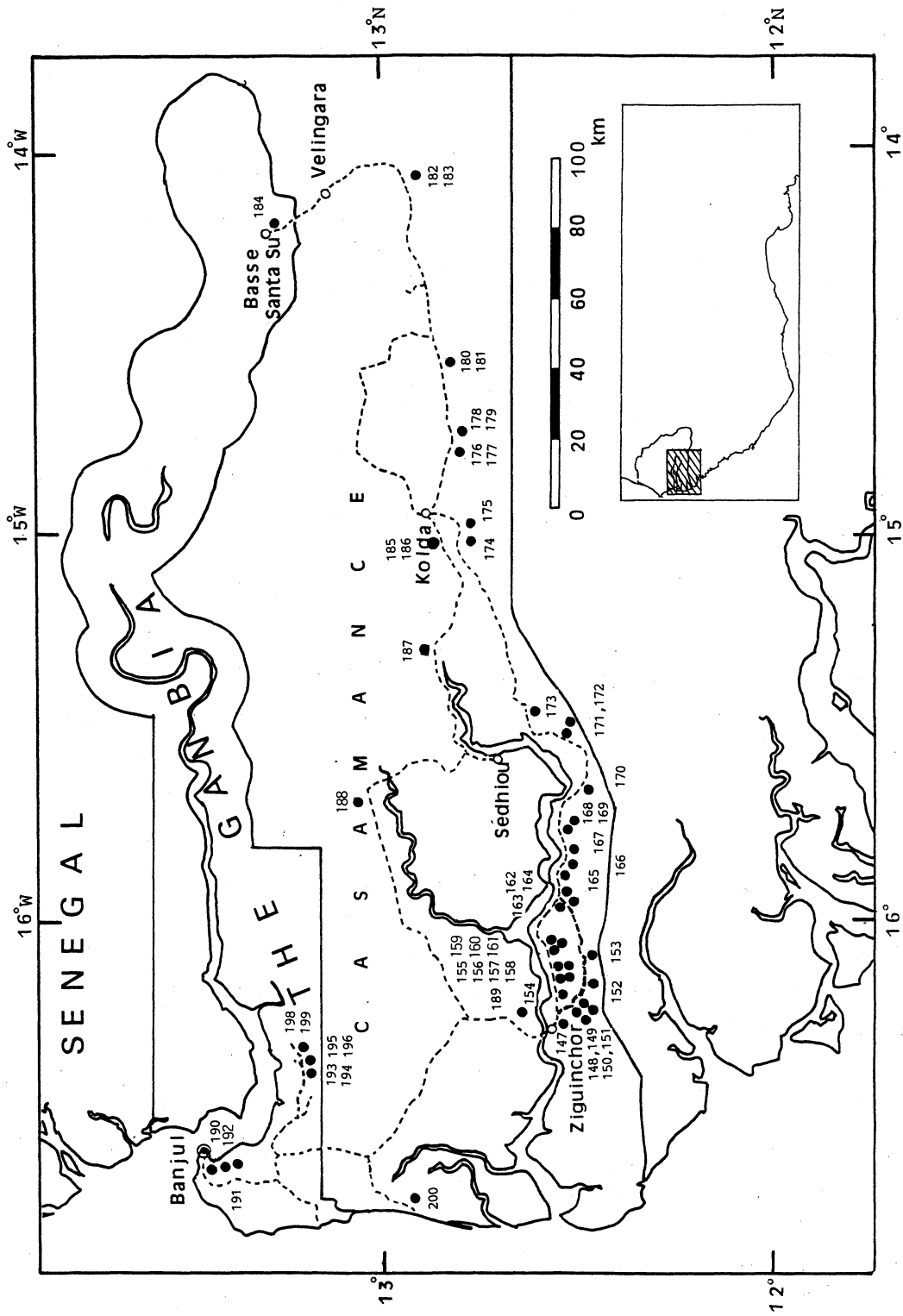


Fig. 1. Map showing several localities where the cultivated rice were collected in Casamance region of Senegal. Dotted lines; routes of observations, filled circles, open circles; collection areas, open circles; main towns. Code-numbers used in the figure are corresponding to the strain number used in the tables.

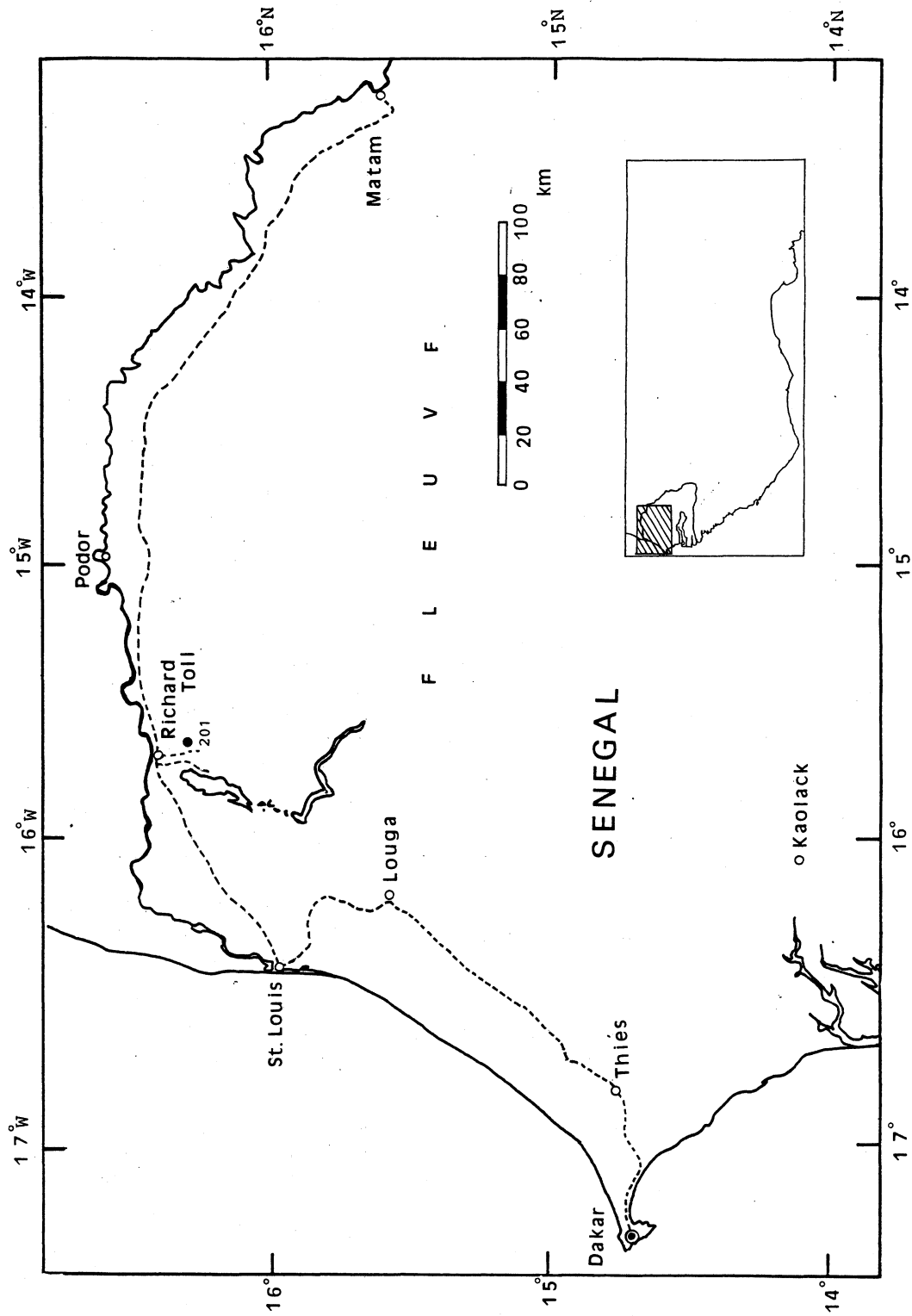


Fig. 2. Map showing a locality where the cultivated rice was collected in northern region of Senegal. Dotted lines; routes of observations, filled circle; collection area, open circles; main towns. Code-numbers used in the figure are corresponding to the strain number used in the tables.

Table 1. Distribution and habitat of cultivated rice collected in Senegal, 1985. Abbreviations: S; *Oryza sativa* L., G; *Oryza glaberrima* STEUD., respectively

Strain No.	Species	Collecting date	Local name	Place, habitat and remarks
147	G	Oct. 30	—	Ziguinchor. Road-side submerged paddy field.
148	G	Oct. 30	—	Near Ziguinchor. Rainfed paddy field. A few plants growing as weed in <i>O. sativa</i> field.
149	G	Oct. 30	—	Near Ziguinchor. Rainfed paddy field. Growing as weed in <i>O. sativa</i> field.
150	G	Oct. 30	Niassaran	Near Ziguinchor. Rainfed paddy field.
151	G	Oct. 30	N'bagnera	Near Ziguinchor. Rainfed paddy field.
152	S	Oct. 30	Waga	Guidel Village, near Ziguinchor. Rainfed paddy field.
153	G	Oct. 30	—	Boutoupo Village, near Ziguinchor. Rainfed paddy field. Growing as weed in <i>O. sativa</i> field.
154	S	Oct. 31	Bilikissa	Niaguis Village, between Ziguinchor and Diattacounda. Rainfed paddy field.
155	G	Oct. 31	Lola coyo	Agnack Village between Ziguinchor and Diattacounda. White grain.
156	G	Oct. 31	Lola wouling	The same field as No. 115. Red grain.
157	G	Oct. 31	Kunu mano	Agnack Village between Ziguinchor and Diattacounda. Swamp surrounded by paddy field. Intermediate form between <i>O. glaberrima</i> and <i>O. breviligulata</i> . Immatured.
158	G	Oct. 31	Lola fingo	Agnack Village between Ziguinchor and Diattacounda. Upland field.
159	G	Oct. 31	Lola woulaigre	Adeane Village between Ziguinchor and Diattacounda. Rainfed paddy field.
160	S	Oct. 31	Boucolonding	Adeane Village between Ziguinchor and Diattacounda. Rainfed paddy field.
161	S	Oct. 31	Tambango	Adeane Village between Ziguinchor and Diattacounda. Rainfed paddy field.
162	S	Oct. 31	Moussou noring	Diagnon Village between Ziguinchor and Diattacounda. Rainfed paddy field.
163	G	Oct. 31	Mano moussou coyo	Diagnon Village between Ziguinchor and Diattacounda. Rainfed paddy field.
164	G	Oct. 31	Mano moussou coyo	Diagnon Village between Ziguinchor and Diattacounda. Rainfed paddy field.
165	S	Oct. 31	Rasta mano	Kaour Village between Ziguinchor and Diattacounda. Rainfed paddy field.
166	G	Oct. 31	Mano moussou coyo	Goudomp Village between Ziguinchor and Diattacounda. Upland field. Mixed-growing with <i>O. sativa</i> .
167	S	Nov. 1	Coungoungoutou mano	Djibanar Village between Ziguinchor and Kolda. Rainfed paddy field.
168	G	Nov. 1	—	Simbandi Balante Village between Ziguinchor and Kolda. Submerged paddy field. Growing as weed in <i>O. sativa</i> field. Awneless grain.
169	G	Nov. 1	—	The same field as No. 168. Awneless grain.
170	G	Nov. 1	Mano moussou	Amdoulaye Village between Ziguinchor and Kolda. Upland field. A few plants remaining in the field where <i>O. sativa</i> was already harvested.
171	G	Nov. 1	Mano moussou fingo	Sindima Village between Ziguinchor and Kolda. Rainfed paddy field. Mixed-growing with <i>O. sativa</i> . Black grain.
172	G	Nov. 1	Woulingo	The same field as No. 171. Red grain.
173	S	Nov. 1	—	Banbatou Village between Ziguinchor and Kolda. Rainfed paddy field.

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174	G	Nov. 1	Mano ouaigue	Dar es Salaam Village between Ziguinchor and Kolda. Rainfed paddy field. Mixed-growing with <i>O. sativa</i> .
175	G	Nov. 1	Fotou	Kitim Village between Ziguinchor and Kolda. Rainfed paddy field.
176	G	Nov. 2	—	Kampissa Village between Kolda and Velingara. Irrigated paddy field in low land. Mixed-growing with <i>O. sativa</i> . Red grain.
177	G	Nov. 2	—	The same field as No. 176. Black grain.
178	G	Nov. 2	Bololo woulingo	Kampissa Village between Kolda and Velingara. Rainfed paddy field. Mixed-growing with <i>O. sativa</i> . Red grain.
179	G	Nov. 2	—	The same field as No. 178. Black grain.
180	G	Nov. 2	Bololo woulingo	Kilidio Saboly Village between Kolda and Velingara. Rainfed paddy field. Mixed-growing with <i>O. sativa</i> . Red grain.
181	G	Nov. 2	Bololo fingo	The same field as No. 180. Black grain.
182	S	Nov. 2	Mano nding wouling	Biaro Village between Kolda and Velingara. Rainfed paddy field. Small grain.
183	S	Nov. 2	Mano nding wouling	The same field as No. 182. Similar type but larger grain than that of No. 182.
184	G	Nov. 3	Bololo wouling	Bassè, GAMBIA. Rainfed paddy field. Mixed-growing with <i>O. sativa</i> .
185	G	Nov. 4	Kebero wouling	Toubacouta Village between Kolda and Sefa. Rainfed paddy field. Mixed-growing with <i>O. sativa</i> . Awned grain.
186	G	Nov. 4	Kebero wouling	The same field as No. 185. Awnless grain.
187	G	Nov. 4	Wer wer	Oudoucar Village between Kolda and Sefa. Rainfed paddy field. Mixed-growing with <i>O. sativa</i> .
188	G	Nov. 4	Eyona	Bonghari Village between Bignona and Ziguinchor. A few plants remaining in the field where <i>O. sativa</i> was already harvested.
189	G	Nov. 5	Mano mano yafitte	Bandiana Village between Ziguinchor and Bignona. Rainfed paddy field. Growing as weed in <i>O. sativa</i> field.
190	S	Nov. 6	—	Banjul, GAMBIA. Rainfed paddy field. Ridge culture.
191	G	Nov. 6	Bololo wouling	Banjul, GAMBIA. Rainfed paddy field. Mixed-growing with <i>O. sativa</i> .
192	G	Nov. 6	Mano moussou	Banjul, GAMBIA. Upland field. Growing as weed in <i>O. sativa</i> field.
193	G	Nov. 6	Mano mano	Pirang Village, GAMBIA, between Banjul and Kafuta. Rainfed paddy field. Growing as weed in <i>O. sativa</i> field. Red grain.
194	G	Nov. 6	Mano mano	The same field as No. 193. Black grain.
195	G	Nov. 6	Mano mano	Fraba Bantan Village, GAMBIA, between Banjul and Kafuta. Rainfed paddy field. A few plants remaining in the field where <i>O. sativa</i> was already harvested. Red grain.
196	G	Nov. 6	Mano mano	The same field as No. 195. Black grain.
197	G	Nov. 6	Bololo blanc	Collection site and habitat are of indistinctness. White pericarp.
198	G	Nov. 6	Mano mano	Lame Village, GAMBIA, between Banjul and Kafuta. Rainfed paddy field. Mixed-growing with <i>O. sativa</i> . Red grain.
199	G	Nov. 6	Mano mano	The same field as No. 198. Black grain.
200	S	Nov. 7	Barafita	Kafoutine. Upland field.
201	S	Nov. 10	D-52-37	Colonat Village, Richard Toll. Submerged paddy field.

Table 2. Some morphological characters of unhusked grains of *O. sativa* collected in Senegal

Strain No.	Length (L) (mm)	Width (W) (mm)	Thickness (T) (mm)	L/W	L/T	W/T
152	7.98±0.22 <sup>1)</sup>	3.48±0.13	2.20±0.08	2.29±0.09	3.63±0.16	1.58±0.06
154	10.54±0.24	2.81±0.08	2.09±0.04	3.76±0.15	5.05±0.11	1.34±0.04
160	8.99±0.25	2.21±0.06	1.83±0.05	4.07±0.20	4.92±0.18	1.21±0.05
161	8.51±0.25	3.21±0.11	2.15±0.07	2.65±0.14	3.96±0.15	1.49±0.07
162	9.27±0.24	3.13±0.12	2.23±0.07	2.96±0.11	4.16±0.20	1.41±0.10
165	7.38±0.20	2.79±0.07	1.98±0.05	2.65±0.09	3.73±0.13	1.41±0.05
167	7.81±0.29	3.10±0.13	2.14±0.09	2.52±0.12	3.65±0.16	1.45±0.09
173	8.30±0.17	3.58±0.10	2.29±0.05	2.32±0.07	3.62±0.10	1.57±0.06
182	6.30±0.29	2.44±0.09	1.73±0.09	2.59±0.11	3.65±0.21	1.41±0.08
183	8.13±0.32	2.88±0.09	2.03±0.13	2.83±0.18	4.04±0.36	1.43±0.09
190	10.56±0.22	2.59±0.11	2.08±0.04	4.09±0.17	5.08±0.08	1.25±0.06
200	7.91±0.27	3.42±0.10	2.25±0.06	2.32±0.07	3.52±0.15	1.52±0.07
Grand <sup>2)</sup> mean	8.46±1.18	2.97±0.41	2.08±0.16	2.92±0.62	4.09±0.57	1.42±0.11

1) Mean of 20 grains and standard deviation.

2) Mean of means in the respective strains (n=12) and standard deviation.

Kampissa, Kilidio Saboly, Sindima, Biaro, Toubacouta, Oudoucar, Bonghari and Bandiana. GAMBIA; Bassè, Banjul, Pirang, Fraba Bantan and Lame. Those were found in rainfed paddy fields, shallow water paddy fields, upland fields, irrigated paddy fields and swamps.

Distributions of cultivated rices collected were listed up in Table 1. In this table, the strain number, the species name, the local name, the date of collection and some informations of the habitat were described.

#### Some morphological characters of unhusked grains

Thirteen strains of *O. sativa* and 42 strains of *O. glaberrima* were collected in this trip and those were used for morphological investigations of unhusked grains. One strain of *O. sativa* and 1 strain of *O. glaberrima* were removed from the investigations, because of the utter immaturities of those grains.

Investigations were done for length, width and thickness of unhusked grains, using 20 grains of each strain. Measurements were done at the largest position of the respective characters. Moreover, of the unhusked grains, calculations were done on the ratios of the following components, namely, 'length to width', 'length to thickness', and 'width to thickness', using average values of the respective characters.

#### I. *O. sativa*

The results are given in Table 2. Lengths of grains were observed to be between

6.30 mm and 10.56 mm. The shortest grain was obtained in strain No.182. The longest grain was obtained in No.190. Average value was found to be 8.46 mm. The standard deviations of each strain, *i. e.*, showing intra-strain variation, were noted to be between 0.17 and 0.32.

Widths of grains were observed to be between 2.21 mm and 3.58 mm. The narrowest grain was obtained in No.160. The widest grain was obtained in No.173. Average value was found to be 2.97 mm. The standard deviations of each strain were noted to be between 0.06 and 0.13.

Thicknesses of grains were observed to be between 1.73 mm and 2.29 mm. The thinnest grain was obtained in No.182. The thickest grain was obtained in No.173. Average value was found to be 2.08 mm. The standard deviations of each strain were noted to be between 0.04 and 0.13.

To make clear the relationships of the three components, *i. e.*, length and width, length and thickness, and width and thickness of unhusked grains, correlation coefficients were calculated. The correlation coefficient between length and width of unhusked grains was ascertained to be -0.14 showing no significant correlation even at 5 % level. The correlation coefficient between length and thickness of unhusked grains was ascertained to be 0.28 showing no significant correlation even at 5 % level. The correlation coefficient between width and thickness of unhusked grains was ascertained to be 0.89 showing significant correlation among them at 0.1 % level. This relation indicated that the wider was the grain-width, the thicker was the grain-thickness.

Ratios of grain-length to grain-width of unhusked grains were observed to be between 2.29 and 4.09. The smallest value was obtained in No.152. The largest value was obtained in No.190. Average value was found to be 2.92. The standard deviation of the whole strains, *i. e.*, showing inter-strain variation, was 0.62.

Ratios of grain-length to grain-thickness of unhusked grains were observed to be between 3.52 and 5.08. The smallest value was obtained in No.200. The largest value was obtained in No.190. Average value was found to be 4.09. The standard deviation of the whole strains was 0.57.

Ratios of grain-width to grain-thickness of unhusked grains were observed to be between 1.21 and 1.58. The smallest value was obtained in No.160. The largest value was obtained in No.152. Average value was found to be 1.42. The standard deviation of the whole strains was 0.11.

As shown in Fig. 3, based on the data obtained concerning the grain-length and grain-width of unhusked grains, the whole strains of *O. sativa* used were classified into three grain types, *i. e.*, A (short type), B (large type) and C (slender type), according to the tripartite classification by Matsuo<sup>3)</sup>. In this figure, code-numbers used are corresponding to the strain number used in Table 1. One strain of them belonged to the A type, 3 strains to the B type and 8 strains to the C type, respectively. As shown in Table 3, average values of grain-length were found to be 6.30 mm in 1 strain belonging to the

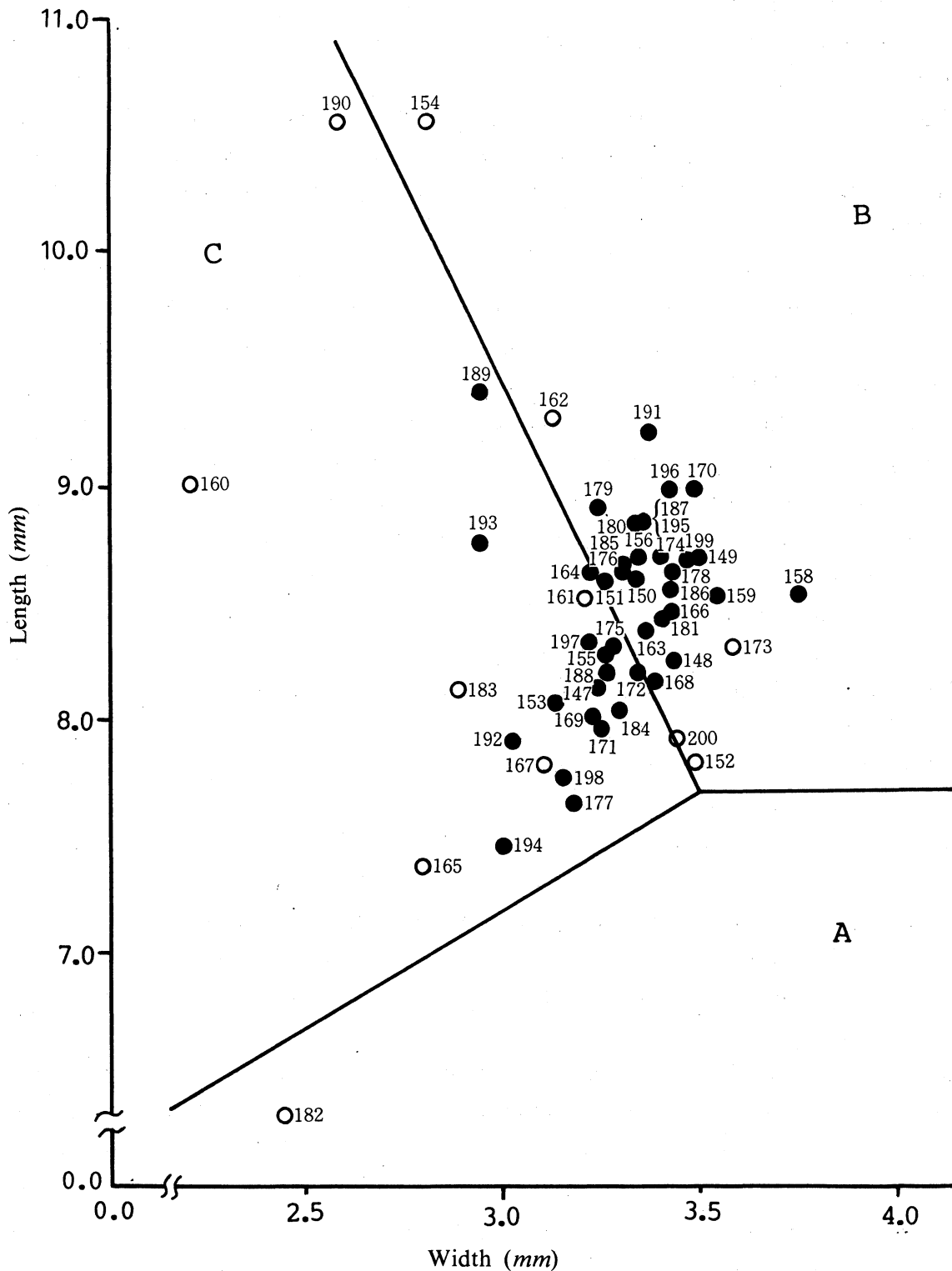


Fig. 3. Classification of grain types of unhusked grains in cultivated rice collected in Senegal according to the tripartite classification by Matsuo<sup>3)</sup>. Vertical axis; length of grain, abscissa; width of grain, open circle; *Oryza sativa* L., filled circle; *Oryza glaberrima* STEUD., respectively. Code-numbers used in the figure are corresponding to the strain number used in Tables 2 and 4.



Table 3. Number of strains and average values of length and width of unhusked grains in *O. sativa* belonging to the respective grain types

Grain <sup>1)</sup> type	No. of strains	Length (mm)	Width (mm)
A	1	6.30±0.00	2.44±0.00
B	3	9.37±0.92	3.17±0.32
C	8	8.39±0.94	2.96±0.46

1) For explanation, refer to Fig. 3.

A type, 9.37 mm in 3 strains to the B type and 8.39 mm in 8 strains to the C type, respectively. Average values of grain-width were found to be 2.44 mm in the A type, 3.17 mm in the B type and 2.96 mm in the C type, respectively. In grain-length, standard deviations of the whole strains in the B and the C types, *i. e.*, showing inter-strain variations, were 0.92 and 0.94, respectively. In grain-width, standard deviations of the whole strains in the B and the C types were 0.32 and 0.46, respectively.

## II. *O. glaberrima*

The results are given in Table 4. Lengths of grains were observed to be between 7.47 mm and 9.38 mm. The shortest grain was obtained in No. 194. The longest grain was obtained in No. 189. Average value was found to be 8.45 mm. The standard deviations of each strain, *i. e.*, showing intra-strain variation, were noted to be between 0.09 and 0.37.

Widths of grains were observed to be between 2.94 mm and 3.75 mm. The narrowest grains were obtained in Nos. 189 and 193. The widest grain was obtained in No. 158. Average value was found to be 3.30 mm. The standard deviations of each strain were noted to be between 0.06 and 0.16.

Thicknesses of grains were observed to be between 1.83 mm and 2.22 mm. The thinnest grain was obtained in No. 194. The thickest grain was obtained in No. 199. Average value was found to be 2.03 mm. The standard deviations of each strain were noted to be between 0.04 and 0.09.

To make clear the relationships of the three components, *i. e.*, length and width, length and thickness, and width and thickness of unhusked grains, correlation coefficients were calculated. The correlation coefficient between length and width of unhusked grains was ascertained to be 0.27 showing no significant correlation even at 5% level. The correlation coefficient between length and thickness of unhusked grains was ascertained to be 0.20 showing no significant correlation even at 5% level. The correlation coefficient between width and thickness of unhusked grains was ascertained to be 0.77 showing significant correlation among them at 0.1% level. This relation indicated that the wider was the grain-width, the thicker was the grain-thickness.

Ratios of grain-length to grain-width were observed to be between 2.27 and 3.19.

